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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Food Handling Machinery

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Food Handling Machinery

FOOD handling has progressed a long way since the horse and wagon age when "fast freight" was measured in terms of days. Today it is scheduled by hours—even given the benefit of right-of-way. But food handling is not confined to transportation alone. It must commence with the raw materials at the packing, canning or quick-freeze packaging plant. The machinery involved is diverse not only in design but also as to function and location. Furthermore, much of it is seasonal in service and mobile in nature.

All this places an unusual load upon lubrication and lubricants. Unless they afford suitable protection to the essential bearings, gears and chains which go to make up the various mechanisms, production schedules may be disrupted and maintenance costs may become too high. We are dealing with a seasonal industry, where raw materials are perishable, where machinery must function under peak load conditions most of the time.

The varied nature of the work to be done calls for a wide range of machinery, viz., the pea harvester to the refrigerating compressor. In between there are the cookers, exhausters, conveyors and canning or packaging devices.

Lubrication of these units must be approached from a dual angle, as we must

1. Protect the machine parts against wear or corrosion, and
2. Protect the foodstuffs being handled against contamination.

Corrosion is a factor which must always be taken into consideration where handling fruits and vegetables, due to the acids of fermentation which may develop. The objective in modern food handling is to expedite the treating processes so that fermentation occurs to the least possible extent. It is difficult, however, to completely eliminate the chance of acid corrosion since some fruits and vegetables are naturally acidic in nature. In their handling or treatment there is often possibility of acid coming in contact with certain of the machine parts. Lubrication protects these parts against corrosion provided the lubricant is not affected by acid contamination.

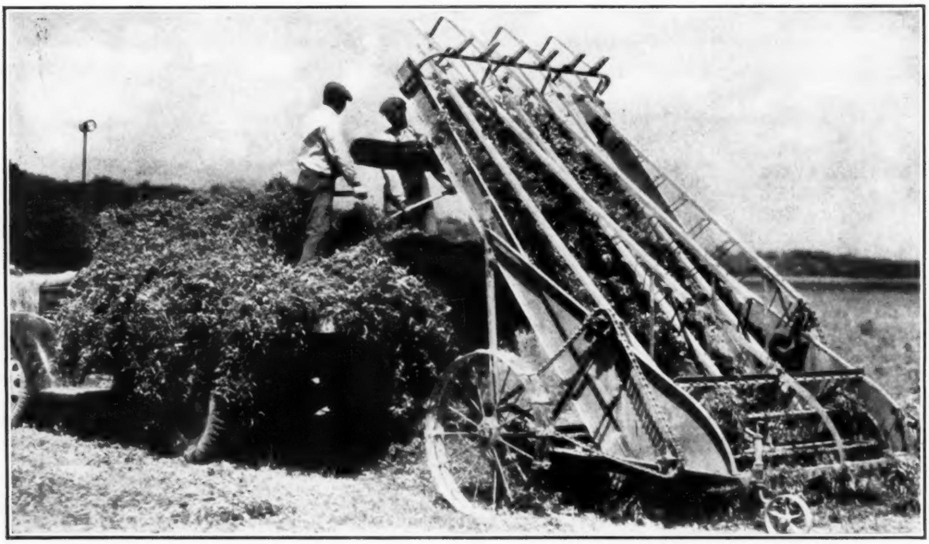
The Prevailing Acids

The most usual acids encountered in such work are malic, citric and tartaric. The former is found in apples, pears, plums and peaches; citric acid is present in oranges, lemons, grapefruit and limes, and tartaric in vegetables. In their natural state, fruit and vegetable juices are weak acids. As such they are often more corrosive to certain bearing materials and machine parts than where higher concentration prevails.

Lubrication can be most effective in preventing these acids from coming into direct contact with the machine parts, when the lubricant itself is highly resistant to chemical breakdown or oxidation. It is aided materially if the parts to be lubricated are designed to insure against loss of lubricant by leakage or throw-off.

Fruit and vegetable acids, or the acids resulting from fermentation, such as acetic, may sometimes have a decomposing effect upon certain of the soaps which are used in grease manufacture. This would leave a mixture of fatty acid and mineral oil, to perhaps render the latter unable to lubricate effectively should the mechanisms involved be so constructed as to allow run-off. Careful selection

of the soap used in initial manufacture of the grease, also in compounding with mineral oil may retard the tendency towards subsequent reaction with any acids with which it may come in contact. It is even better, however, to decrease the possibility of such contact by designing the machinery parts so that entry of these acids will be prevented.



Courtesy of Frosted Foods Sales Corp.

Fig. 1—Pea harvesting, showing method of gathering, the vines with pods attached, and loading for transportation to the sheller.

Oil-tight housings for gear and chain elements, leather or synthetic seals for sleeve bearings, and prepacked or cartridge type ball bearings are ideas which may be very helpful in this regard.

Unless these precautions are taken, corrosion and sludge formation may be active possibilities. Corrosion is especially objectionable when it develops in ball or roller bearings as it prevents free rolling of the elements, causes noise and leads to other conditions which may ultimately require bearing renewal. Sludge in turn may interfere with free rolling in ball or roller bearings, it may prevent free circulation of lubricant, or it may be the cause of gum formations whenever oxidizing conditions may prevail.

Selecting the Lubricant

In the lubrication of parts which may be exposed to fruit or vegetable juices or the acids of fermentation, it is therefore always advisable to insist on most carefully refined lubricating oils and greases. By using petroleum products which will be resistant to the solvent action of the prevailing acids, the stability of such lubricants will be more dependable, likewise their ability to prevent acids from penetrating through the lubricating films to come in contact with the operating mechanisms. This holds true all the way from the harvester or conveyor to the canning machine.

The fact that we must be concerned with the possibility of corrosion, requires that the potential acid characteristics of petroleum lubricants for food handling equipment must be known. Corrosion may become especially serious where highly polished steels are involved as, for instance, in ball and roller bearings. So, if the lubricant employed on such mechanisms develops acidity in service, serious difficulties may result. In addition to corrosion, sludging, gum formation and the accumulation of corrosive deposits may be very likely.

The petroleum chemist determines this by study of the "neutralization number." This involves a test which measures the amount of mineral and organic acids present in an oil, by noting the weight in milligrams of potassium hydroxide necessary to neutralize one gram of the oil under test. Usually the amount of mineral acids in a new oil is negligible; thus the "neutralization number" is directly proportional to the amount of organic acidity.

In dealing with acidity much study has been given to the relation which may exist between this characteristic and emulsification or sludge formation. The acid-forming constituents are very complex and knowledge of their reactional effect is still quite limited. Petroleum research, however, is continually investigating

more effectual means of removing the objectional components. Improved stability of straight mineral lubricating oils as measured by accelerated breakdown tests indicates the success of this research to-date.

Oxidation and Gum Formation

Petroleum greases and mineral oils will be subjected to more or less oxidation in the presence of air, when exposed to contact with water, especially under higher temperatures. These conditions are normally so involved and so contingent upon one another, however, that no one of them can be rightly claimed as being more detrimental than the other. On the whole, however, it may be stated that the extent to which any lubricant will resist oxidation depends largely upon the selection and refinement of the original materials; some will tend to oxidize more readily than others.

Modern refinery practice, therefore, endeavors to remove these components by careful and accurate refining. The more reliable the manufacturer, naturally the more dependence can be placed on his methods of refining. Oxidation will, of course, occur in practically any oil if it is subjected to oxidizing conditions. In fact, wherever particles of air and water are suspended or retained within the body of an oil to form an emulsion, only a slight elevation of temperature during operation will be necessary to bring about an oxidizing reaction between the air and oil. As an adjunct to emulsification, oxidation may be said to have certain advantages. As the forerunner of sludge formation and development of acidity, however, it is a detriment.

CONVEYING OPERATIONS

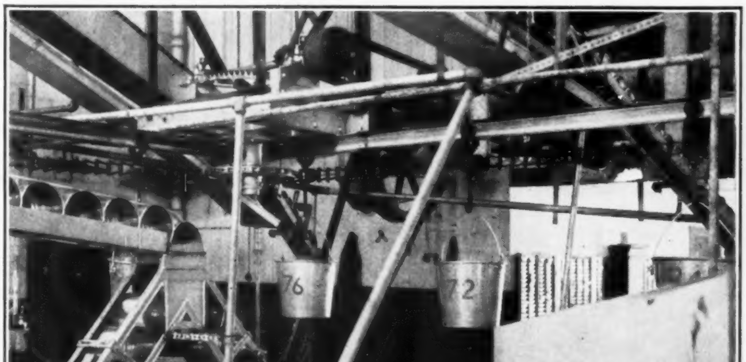
The conveyor is probably the most important piece of correlating equipment in any food handling or processing operation, for regardless of the materials being handled or the treatment to which they are subjected, their position must be continually changed. This is only practicable with adequate means of conveying.

As the latter was improved, production methods and plant schedules were materially expedited. Likewise, as more attention was given to conveyor bearing design, to housing seals and to means of protecting lubrication, so was dependability of the entire conveying system improved.

Study of these factors by conveyor builders and bearing designers was prompted by appreciation of the rough service to which conveyors in food handling service will be so frequently subjected. Rugged construction will enable the average conveyor to operate apparently irrespective of the care received, the loads applied or the type of lubrication. Some operators may even go so far as to assume that no lubrication at all is necessary, especially where extreme moisture conditions may prevail. Even then conveyors have the happy faculty of continuing to run for a considerable period of time.

Such an attitude, however, does not help production costs. Lubrication and judicious maintenance must be properly carried out for costs of up-keep must be reduced. This also has a relation to power consumption for operating of a conveyor requires power and it is amazing how power consumption will increase if operating conditions are unfavorable and if frictional resistance is allowed to build up.

Friction, of course, can never be eliminated. There must always be some resistance to motion developed between any moving parts regardless of their design. So a certain amount of wear always must be expected between bearing surfaces, rollers, chains, sprockets or gear teeth. If this is allowed to continue, ultimately the conveyor will have to be shut down for repair. This means loss of production. Fortunately, however, friction and ex-



Courtesy of The Jeffrey Manufacturing Co.

Fig. 2—Drive end of a Jeffrey trolley conveyor handling tomatoes in a packing plant.

cessive wear can be materially reduced by effective lubrication provided, of course, that the parts have been designed for protection of the lubricant in service and for periodic adjustment to compensate for wear.

Courtesy of The Jeffrey Manufacturing Co.
Fig. 3—Drive end of a Jeffrey wood apron conveyor handling fruit materials in the tropics.

Features of Design

A considerable variation in conveyor design is applicable to food handling operations. Some types of conveyors will require considerable manual attention especially where independently operated power mechanisms are involved. In this article, however, we will deal principally with the so-called automatic conveyor of the screw, belt, bucket or allied type which forms the connecting link between various processing operations in the modern cannery.

The screw conveyor consists essentially of a stamped or rolled steel spiral which is secured by lugs to a shaft or rod. The ribbon conveyor in turn consists of a ribbon flight similarly secured to the shaft or rod with an open space between the ribbon and the shaft.

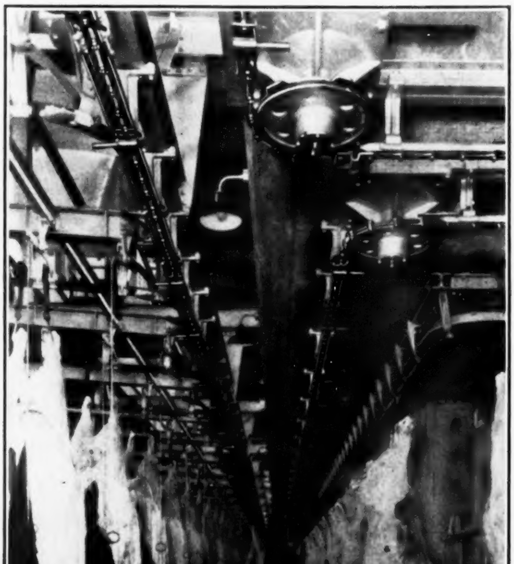
The screw conveyor is also termed a spiral conveyor. It is designed for horizontal movement of comparatively dry materials in contrast with the ribbon conveyor which is capable of handling damp or sticky materials which would otherwise build up around the shaft of a spiral conveyor.

Another type of conveyor adapted to unabrasive materials is the scraper or flight conveyor. It functions by dragging the product along a trough by means of flights which are usually made of wood. A scraper conveyor can be used in either horizontal or inclined service. It is built with either a single or double chain to which are bolted the flights or scrapers. As stated, these latter scrape the material along the trough which is provided with discharge points governed by suitable gates.

Where vertical conveying of materials is desirable, the bucket type of conveyor is widely used. This involves the use of bucket-shaped scoops which take the place of flight or apron blades. The buckets differ in design according to the type of materials to be handled. Regardless of the type of bucket, however, the principles of operation are essentially the same.

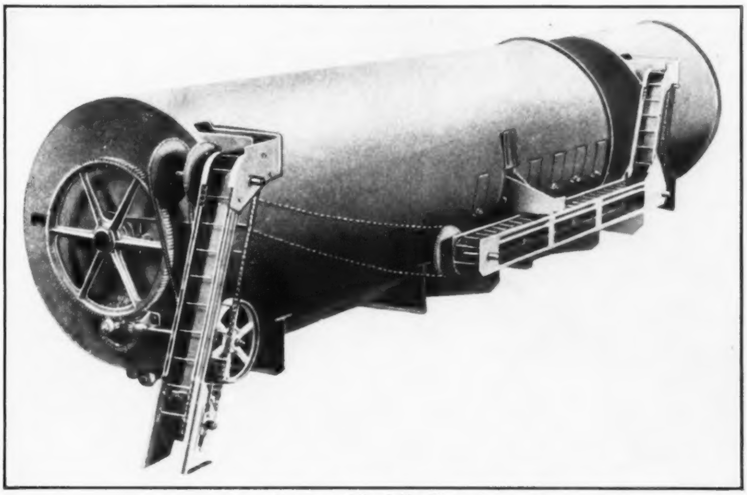
Bucket conveyors will handle practically any material which will not adhere to the containers. These latter are carried between a pair of roller chains, on a strand of chain or in some installations on a belt. They may be located either vertically or on an incline and have continuous or non-continuous buckets. The discharge or intake of any such container will obviously depend upon the locality and the materials to be handled.

In addition to the above types of conveying devices, there is also the apron conveyor. This unit is capable of handling any material which will not adhere to the carrying surface or leak through any part of the conveying medium. Such a conveyor is made up of two sets of roller



Courtesy of Link-Belt Company
Fig. 4—Beef handling on a Link-Belt steel chain pusher-type overhead conveyor.

chains separated by over-lapping apron plates which form the carrying surface. The chains are driven by sprockets at one end—take-ups being provided at the other end. This conveyor pulls the material toward the driving end at which point one must also provide for discharge.



Courtesy of Food Machinery Corp., Anderson-Barngrover Division

Fig. 5—A round shell cooker and cooler. All bearings are babbitted and provided for pressure grease lubrication. Gear lubrication is important due to exposure.

The belt conveyor is also applicable to cannery service. With this device we are dealing with an endless belt of fabric which is designed to travel over pulleys at the conveyor ends and over idlers located at suitable intervals between each end of the unit. This type of conveyor will handle any material in bulk which will not adhere to it and which can be fed automatically. It is also well suited for handling of packaged goods up to an angle of around 20 degrees. The belt conveyor can be used in service where lubrication of certain of the parts might otherwise become contaminated as its conveyor and idler rollers operate on anti-friction bearings which have been very carefully designed to enable protected lubrication. Application of lubricants is therefore only necessary at infrequent intervals provided a specially prepared anti-friction bearing grease is used.

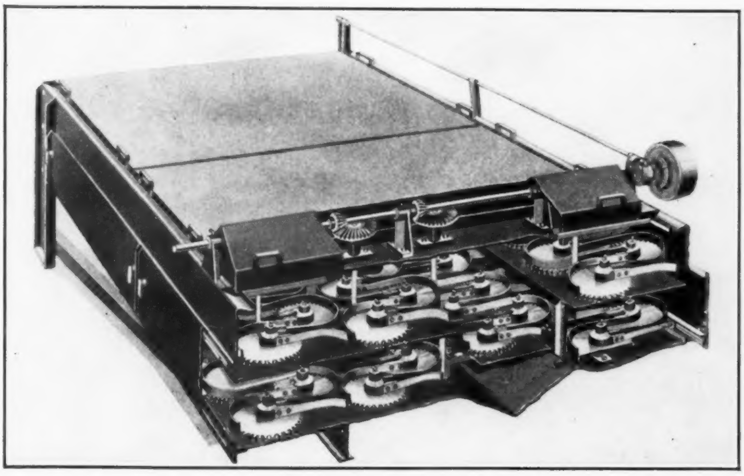
TEMPERATURE RANGE

A considerable range of temperature prevails in food handling. Where canning is practiced this range is comparatively high as steam cooking, digesting and sterilization machinery necessarily develops a heat condition which is more or less transmitted to the operating parts.

Conversely, in quick freezing, refrigerating machinery capable of functioning as low as fifty degrees below zero Fahr., is necessary. Here we are concerned with the lubrication of the refrigerating compressors.

Cookers, Exhausters and Digesters

Equipment of this type which constitutes the finishing machinery incidental to canning, involves a temperature and sometimes a moisture condition which may frequently impose quite a severe duty upon the lubricant which must serve the internal bearings. Oil lubrication is usually employed on the cooker, the machine being designed for delivery of oil to each bearing through copper tubing running from the central source of supply. To meet the operating conditions a comparatively heavily compounded oil is usually advocated—the com-

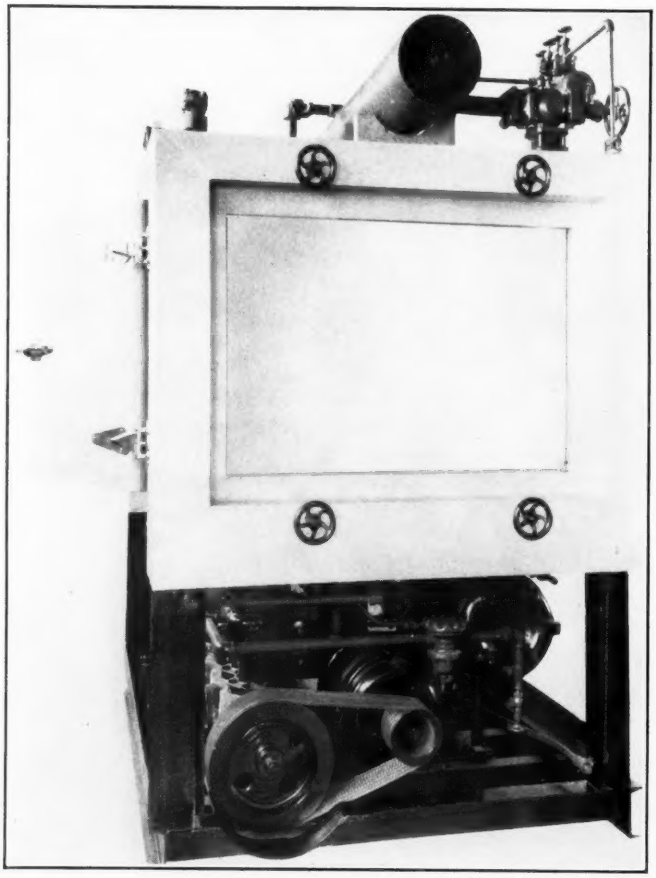


Courtesy of Food Machinery Corp., Anderson-Barngrover Division

Fig. 6—Details of a disc exhauster. This unit is grease lubricated, the manufacturer specifying a high-temperature-resisting product which will emulsify with steam or water.

pound being intended to aid in resisting water-wash by formation of an emulsion. At the same time the mineral base of the oil should have adequate viscosity or body to withstand the prevailing temperatures so that a dependable lubricating film will be maintained.

Pressure grease lubrication in turn, is used on many digesters and exhausters. To adequately protect the vertical bearings and gear hubs under the prevailing operating temperatures which may sometimes exceed 200 degrees Fahr., a high-temperature-resisting grease is advisable. This qualification is indicated by the melting point which should be well above the bearing temperature. This grease should have good emulsifying properties so as to be able to function effectually under moisture conditions. Such a grease should, of course, show no tendency towards separation of its oil from its soap content; in addition, it should be highly resistant to gum formation and oxidation. These properties have been carefully studied by the grease chemist.



Courtesy of Frosted Foods Sales Corp.

Fig. 7—A Birdseye Frosted Foods portable quick-freezing unit complete with compressor. This is a cabinet type froster containing five compartments and five trays. The process involves freezing packaged products under controlled pressure between refrigerated flat metal surfaces such as belts or plates.

On the frame base beneath the cabinet is located the compressor, motor, condenser, hydraulic lift cylinder, hydraulic oil tank and pressure pump direct-connected to the operating motor.

Refrigeration and Quick-Freezing

Refrigeration is also a finishing process, likewise an adjunct to food preservation. In quick-freezing the process is based upon the crystallization characteristics of the moisture content and the cell structure of the food products. Satisfactory preservation is obtained by congealing this moisture to crystalline form so as to retard dehydration and fermentation. When relatively large crystals are formed in the cell structure, the latter may be ruptured. When this has occurred defrosting disturbs the natural texture of the material, also the flavor. Research has proved that relatively slow freezing causes larger crystals. Hence the endeavor to speed up the freezing rate. This is the basis of modern quick freezing.

As this requires refrigerating machinery capable of functioning at considerably lower temperatures than prevail in conventional cold storage service, the lubricating engineer must be thoroughly familiar with the operating conditions. Frequently temperatures as low as 40 to 50 degrees below zero Fahr., prevail.

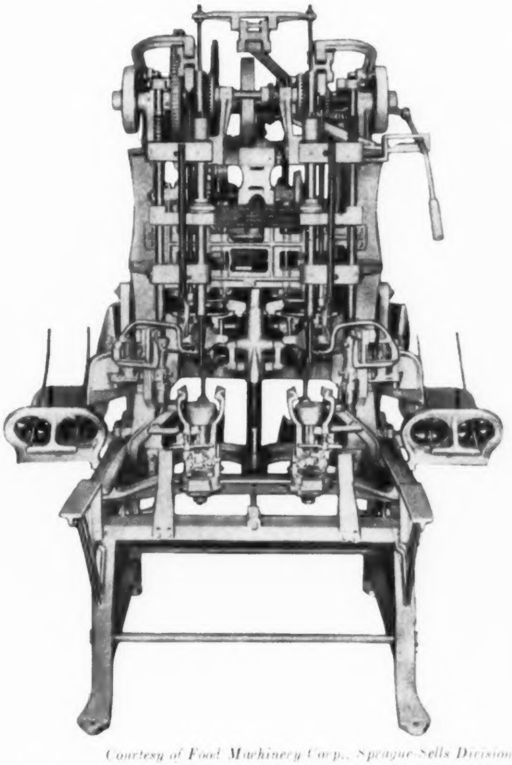
Specialty refrigerating oils are necessary for lubrication of the compressors which are subject to these conditions. It is not sufficient to use an oil of low pour test; resistance to chemical breakdown or wax separation is even more important. The former because it may result in objectionable sludge accumulations; the latter, due to the probability of wax congealment at the expansion valve or within the evaporator. Then the heat transfer ability of the system will be affected.

Laboratory Research

So, study of refrigerating machinery lubrication has become a major endeavor in the petroleum research laboratory. This has required a thorough knowledge of the principles of refrigeration, investigation of the characteristics of refrigerants, evaluation of innumerable grades of crude oil, and laboratory refinement

to determine the types of lubricating stocks available.

The behavior of petroleum lubricating oils in the presence of the various refrigerants



Courtesy of Food Machinery Corp., Sprague-Sells Division

Fig. 8—The Coons combination apple machine. Rapid handling avoids oxidation.

employed for food preservation purposes is interesting. It materially affects the extent to which oil carry-over may occur, especially under pressure. The extent of miscibility is also a factor. Ammonia, the most widely used refrigerant in food preservation operations, is fortunately not readily miscible with petroleum oils though some slight physical mixture can occur under certain pressure conditions.

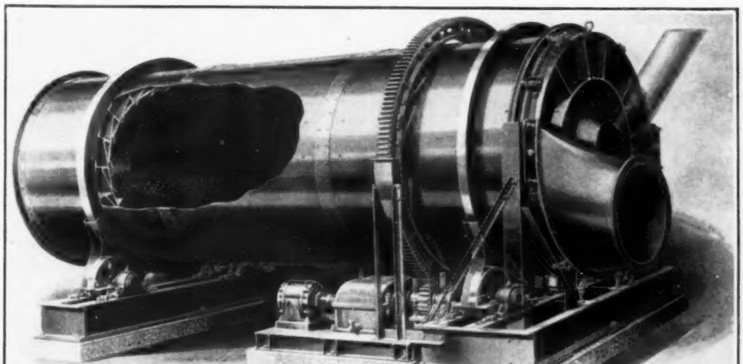
Some of the other well-known refrigerants, however, are more miscible, going into solution with petroleum lubricating oils, to reduce the viscosity of the latter, also their pour test to some extent. As oil-refrigerant mixtures of this nature are difficult to break, regardless of the efficiency of the oil separator, the systems are designed to prevent oil-refrigerant contact as much as possible.

Inasmuch as in any mixture of oil and refrigerant gas, the oil is usually in the liquid phase, even though very finely dispersed, a condition prevails which is favorable to separation, as liquids separate more readily from gases than from liquids.

Heavy duty refrigerating machinery is lubricated by splash or pressure. The latter can be applied to the lubrication of both vertical and horizontal machines. Splash lubrication, however, is more adapted to the vertical compressor. The system involved for the lubrication of compressor cylinders, stuffing boxes and enclosed bearings will have a decided influence upon the grade of the oil that should be used.

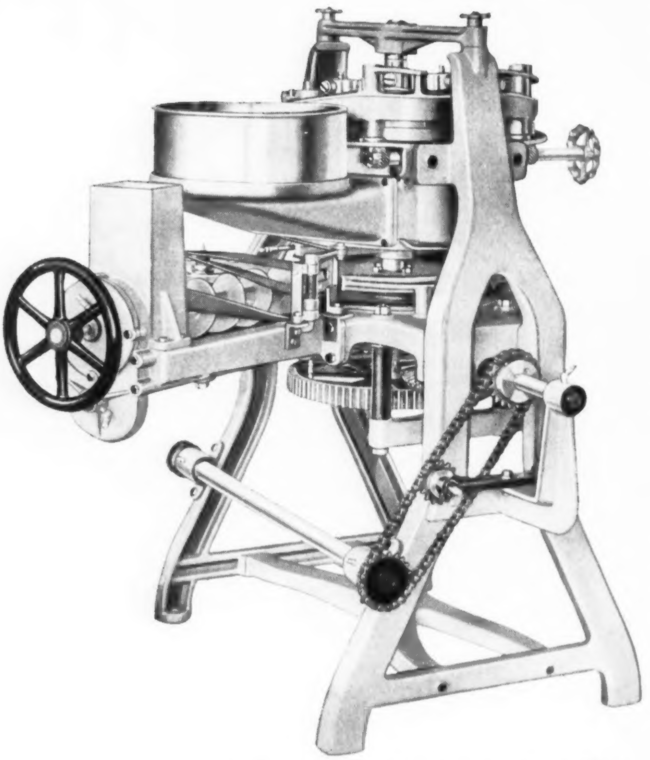
Splash Lubrication

In a system of this type oil is automatically circulated or splashed by the rotating crank, the level in the crankcase being maintained just high enough to permit this element to dip and splash a copious amount of oil to the cylinder walls and other contact surfaces. As the compressor continues to operate, the crankcase becomes filled with a lubricating vapor above the main body of oil. This, in turn, will insure added lubrication of all main, wrist-pin and crank-pin bearings. Good judgment must always be used in controlling the oil level, for if it becomes too high the oil may be churned by the crank, to bring about such violent agitation in the main body of oil as to preclude effective precipitation of any solid impurities that may be present. There is also the possibility of lubricant passing the piston rings, to enter the condensing and evaporating parts of the system, impose an added load on the oil separator or even interfere with refrigerating



Courtesy of Link-Belt Company

Fig. 9—Showing the Link-Belt Roto Louvre dryer. This machine is adapted to the handling of a variety of food products, where drying by heat, or cooling is to be done.



Courtesy of Food Machinery Corp., Sprague-Sells Division
Fig. 10—The Hansen high speed plunger filler as used in cannery service. Note location of the operating mechanisms.

suitability of the latter and the extent to which effective lubrication is being accomplished.

Pressure Lubrication

Pressure lubrication in contrast with the splash method, controls accurately the amount of oil delivered to cylinder walls and compressor bearings. Such a system, however, will require more equipment, piping, etc., and frequent filling of the reservoir (where a mechanical force feed lubricator is involved) and more attention from the operator. On the other hand, pressure lubrication enables more effective filtration or purification of the oil, especially where there is complete circulation and a suitable filter is employed.

The mechanical force feed lubricator is extensively used where compressor cylinders are to be pressure oiled. Excellent economy will be attained by regulating such lubricators so that just enough oil is delivered to maintain the requisite lubricating films, with drainoff reduced to a minimum.

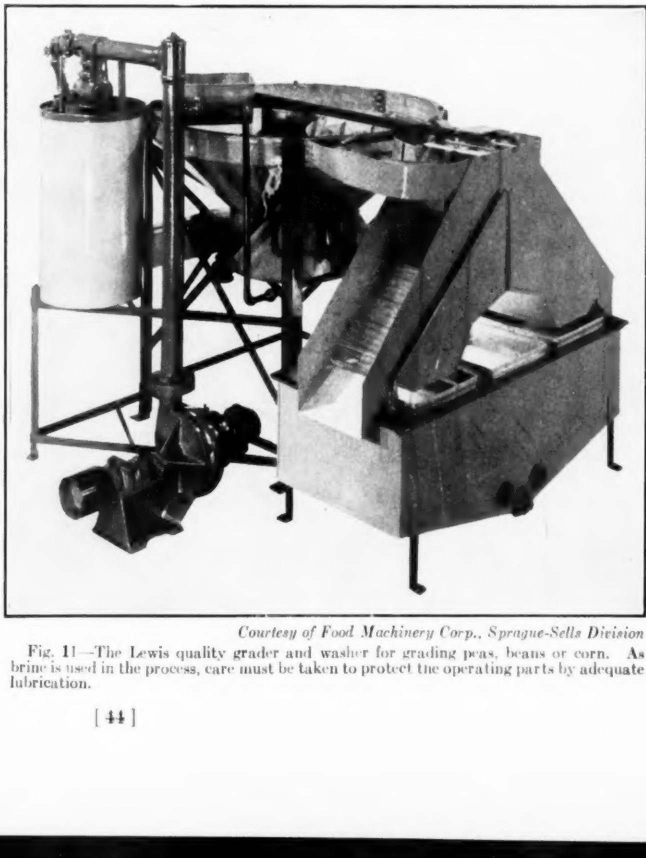
The mechanical force feed lubricator enables independent lubrication of the internal and external parts; in other words, using this de-

efficiency. This may be especially aggravating if the rings are not tight or where the oil may have a tendency to congeal at too high a temperature; hence the requirement for low pour test in refrigerating oils.

Sludge Elimination

Excessive oil, in a splash lubricated system, will also involve the possibility of difficulty when draining and cleaning, especially where sludging has developed. Certain oils when splash agitated in a crankcase will give rise to sludge formation if they have not been highly refined. In part, this is due to chemical reaction of ammonia with certain constituents of the oil. It will be most probable where water is present or if the oil or ammonia is contaminated with foreign matter, such as dirt, metallic particles or carbon.

Regular periods for cleaning should be observed, therefore, with careful investigation of the condition of the used oil, for this will very often indicate both the approximate



Courtesy of Food Machinery Corp., Sprague-Sells Division
Fig. 11—The Lewis quality grader and washer for grading peas, beans or corn. As brine is used in the process, care must be taken to protect the operating parts by adequate lubrication.

vice with perhaps three outlets for cylinder and stuffing box or oil lantern service, and an independent gravity or mechanical pressure circulating system for all other moving parts.

Selection of Compressor Oils

Choice of lubricants for refrigeration service requires due regard for the duty involved and the operating conditions that will probably be encountered. To overlook or to disregard the importance of such factors as the method of lubrication, the temperature in the expansion or refrigerating coils, the mechanical condition of the compressor, etc., and the location, type and efficiency of the oil separator may frequently lead to marked increase in maintenance costs and reduction in capacity, as well as time lost due to shutdown.

In this regard, pour test and viscosity require primary consideration, for it is these characteristics which will be indicative of the extent and degree of success with which any lubricant will function, in accordance with the particular operating and constructional conditions prevailing. It is obviously most important that an oil for refrigerating machinery lubrication shall remain fluid at the lowest temperatures to which it may be subjected during operation. These temperatures will be encountered beyond the expansion valve in the expansion or refrigerating side of the system. Many oils, of course, by virtue of their base and degree of refinement, will not be able to withstand lower temperatures without congealing to a certain extent, depending upon the nature of their wax content.

When this occurs it indicates that a film of oil will be deposited on the inner surfaces of the refrigerating piping, to form more or less of an insulating medium which will prevent proper abstraction of heat from the compartment or medium which is to be cooled. If this is allowed to continue, the refrigerating capacity of the system will be reduced and ultimately it will be necessary to clean out these congealed oil deposits, to bring back refrigerating efficiency.

The pour test essential to refrigeration service must, therefore, be sufficiently low to insure continued fluidity at the lowest temperatures prevalent in the evaporating side of the system. There should also be sufficient viscosity throughout the range of operating temperatures to enable the oil to serve at all times as an effective lubricant for the moving parts, as well as an adequate seal to prevent blow-by of gas past the piston rings.

A refrigerating compressor oil must also at all times be practically free from water, otherwise this latter may freeze if carried over to the refrigerator coils, in which case it would probably remain in the system and result in a certain decrease in evaporative efficiency and cooling capacity.

Courtesy of Food Machinery Corp., Sprague-Sells Division

Fig. 12—Part of the lubricating system on a universal corn cutter. An automatic lubricating pump and complete "Bijur" oiling system to all bearings and moving parts is a feature on this machine.

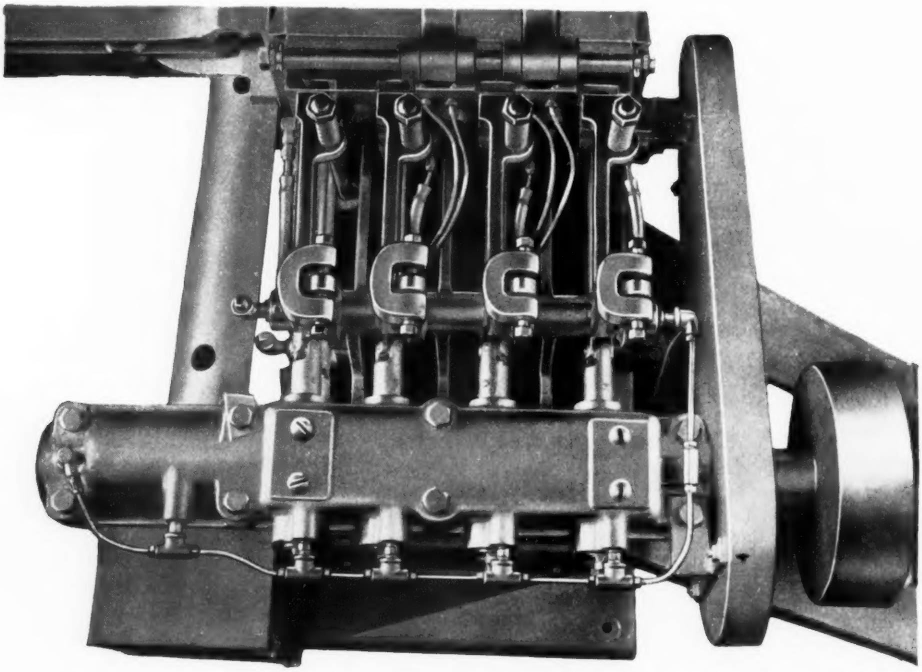
Inasmuch as packing operations will normally involve the ammonia type of compressor, straight mineral filtered oils having a viscosity of from 150 to 200 seconds Saybolt at 100 degrees Fahr., should be usually satisfactory where the temperature in the refrigerating coil is below 0 degrees Fahr. Above this temperature, however, an oil of somewhat higher viscosity, i.e., 200 to 300 seconds Saybolt, will give more protective lubrication.

The purest grade of straight mineral oil obtainable should always be used in order that the above requirements will be adequately met. Oils of this nature will have a sufficient range of physical properties to lubricate compressors effectively under all normal conditions of operation. Animal and vegetable oils are not suitable for such service inasmuch as they will have a tendency to congeal at low temperatures and gum at higher temperatures. They may also react to a certain extent with ammonia, to cause the formation of sludge.

The viscosity is especially important where enclosed crankcase, high speed machines of the

wet compression type are involved. As a rule, oils should be used which will stand considerable churning in the presence of the refrigerant and a certain amount of water vapor. Here one oil lubricates the entire machine. As a result, it must be capable of serving both the cylinders and bearings. It should not emulsify to any great extent, for this might result in clogging of the lubricating lines, or impairment of refrigeration should the oil work past the piston rings and over to the refrigerating side of the system. From a mechanical point of view the seal and compression-forming ability of an oil is practically as important as its lubricating properties.

Higher viscosity oils should also be considered where cylinder walls and rings may be worn or scored. Usually an oil having a viscosity of 300 seconds Saybolt at 100 degrees Fahr., will be satisfactory in this event. Obviously, therefore, the physical condition of the valves, piston rings and stuffing boxes must always be considered in deciding upon the viscosity. There will be greater tendency for horizontal compressor cylinders to wear out of round than those of vertical machines. In consequence, such compressors may often require a fairly heavy lubricant. It is not advisable, however, to attempt to compensate for wear by increasing the viscosity too much on account of the possibility of reduction in cooling capacity due to possible congealment.



Courtesy of Food Machinery Corp., Sprague-Sells Division

Fig. 13—Rear view of the universal corn cutter showing in detail the automatic oiling lines running to all bearings.

APPLICATION OF LUBRICANTS

Given a type of lubricant which is resistant to breakdown in the presence of fruit or vegetable acids, its application must then be considered. Design is of course a factor. As gear sets are usually assembled in a housing which not only prevents loss of lubricant, but also undue contamination, they are not of as much concern as the various machine bearings. These latter vary in design, in their method of sealing and in their proximity to the materials being handled. They may be of either the sleeve type, or ball or roller bearings; they may be provided for oil or grease lubrication. The latter predominates on much of the modern machinery used in the cannery or quick-freezing plant. Furthermore, as intricate mechanisms have been perfected for food preparation, viz., for peeling, coring and slicing, methods of lubricant application have been improved.

Pressure is most effectual in maintaining the required amount of grease in the bearings; furthermore, applying this grease under pressure forces out contaminants or acid liquors from the bearings housing. In peeling, coring and slicing a considerable amount of juice may be present; if it gets into the bearings, especially

if they are of the ball or roller type, as it is acidic, it may lead to corrosion if the lubricant cannot completely cover and protect the bearings parts.

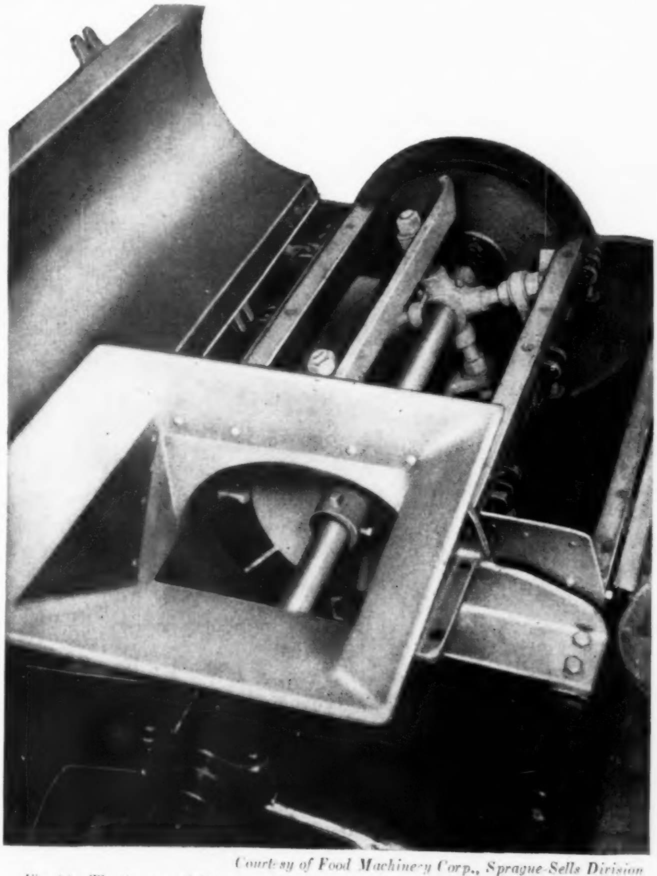
The pressure grease gun used in conjunction with a suitable fitting attached to the bearing is very effective in protecting any type of bearing against the corrosive effects of chemicals, water or other non-lubricating matter. The bearings of course must be designed for this type of lubrication. It is obvious that one should not use grease in a ring-oiled bearing or in a system designed for oil circulation.

The Evolution of Pressure Grease Lubrication

Pressure grease lubrication became a reality with the development of the compression grease cup. For the purpose intended, it proved to be a dependable means of lubrication, provided machine operators could be relied upon to attend to its adjustment and filling at regular intervals. It was, and still is, a simple device, of low cost, but of limited capacity, and subject to contamination of its grease contents. Furthermore, the pressure developed is variable.

With improvements in machine design the need developed, therefore, for more positive means of grease lubrication, for better retention of grease by bearings, and for more consistent pressure during application. This presented certain desirable features, viz.:

(a) That the mechanism should be able to deliver grease under sufficient pressure to insure that an adequate film of lubricant is constantly maintained in the clearance spaces of the sleeve bearing, or on the moving elements in a ball or roller bearing.
(b) That the least amount of labor be required for operation.
(c) That foreign matter be effectually excluded.
(d) That hazard during handling be reduced or eliminated, and
(e) That the least amount of grease be used for the bearing in question.



Courtesy of Food Machinery Corp., Sprague-Sells Division

Fig. 14—The Sprague-Sells super pulper. Timken roller bearings are employed on this unit. Stainless steel, bronze, brass or monel metal is used on all parts which actually come in contact with the product.

The Pressure Grease Gun

With the development of this device and certain auxiliaries such as the spring-type cup and central control, these features have been realized. Furthermore, the pressure gun afforded a means of handling heavier greases under higher power.

Application of centralized pressure whereby a number of bearings can be lubricated from a central point of control further reduces the hazard item; also the labor cost of relubrication. The pressure grease gun is of decided value as an all-round means of lubrication in the modern cannery, for it is applicable to individual lubricators, the spring type grease cup or a centralized system.

The spring type cup is a unique device which is especially useful on bearings which may be so located that hazard or difficulty is experienced during relubrication. Here the ample grease capacity of the lubricator is a definite advantage. The cup itself is fitted with a spring of particular tension, along with a plunger, indicator rod, and an orifice which enables steady discharge of grease at comparatively uniform pressure.

The lubricator is filled by attaching a pressure gun to a suitable fitting located in the base

of the cup. As grease is delivered into the cup below the plunger the latter is forced upward to compress the spring. The extension of the plunger rod above the top of the cup serves as an indication to show how much grease is available below the plunger. The cover need not be removed, so possibility of grease contamination is effectually reduced. In operation the mechanical action of the spring against the plunger which is in direct contact with the grease charge, automatically maintains a constant discharge of grease through the orifice adjacent to the bearing.

Pressure lubrication whether it is developed by the gun itself or an auxiliary lubricator, should not be confused in principle with the compression grease cup. The latter is strictly a hand-operated device; in this respect it is similar since some pressure is applied to the grease, but the effect is much less than the gun or spring type cup can develop. So, there is less probability of cleaning bearing clearances of old grease.

Under load conditions which may require higher pressure at grease delivery than is available in a hand gun, the power operated lubricator should be used. This pressure is especially helpful in clearing plain bearings. In doing this, however, care must be observed in deciding when the bearing has been completely flushed and re-filled with new grease, otherwise waste may result, also a sloppy hazardous condition around the machine.

Full or continuous pressure is only applicable to the sleeve-type plain bearings; if applied to the ball or roller bearing the seals may be impaired if too much grease is charged. This type of bearing is more compactly built, it also resists entry of moisture or foreign matter better than the plain bearing unless the latter is specially sealed. So, the pressure gun should be carefully used on a ball or roller bearing. Never try to fill the housing completely; in fact, half full is ample in order that there may be space for expansion without possibility of leakage; too much grease in a ball or roller bearing may also cause overheating and increase the power consumption.

Chains and Gears

The extent to which gears and chains may be used on machinery incident to preparation or handling of food products will render it advisable to have a thorough understanding of the essentials of gear lubrication. There are certain definite properties which a gear lubricant should possess if it is to function effectively in such service, viz.:

1. Sufficient lubricating ability to insure the reduction of both solid and fluid friction to a minimum.
2. Viscosity or body commensurate with the method of lubrication and the amount of heat that may be encountered, so that a suitable film will be maintained continually between the teeth or chain links. This must resist both pressure and temperature. The former exerts a squeezing out action; temperature affects the fluidity.
3. A sufficient degree of adhesiveness so that in event of use under exposed or semi-enclosed conditions a suitable film will remain on the teeth to resist the throw-off effect of centrifugal force.
4. As little tendency as possible to congeal, harden, crack or become brittle when used under low temperature conditions; or, to carbonize and chip if exposed to abnormally high temperatures.

To reduce wear, noise, misalignment of parts, rusting, stripped teeth, vibration, etc., these requirements should always be given consideration; studying them from the viewpoint of their relative importance, according to the design, mode of operation whether or not automatic or bath lubrication is practicable, and the nature of the installation.

CONCLUSION

If space were to permit, it would be helpful to discuss in more detail the actual lubrication of the variety of specialized operating mechanisms which are essential to the packing and canning industries. In part, these are brought out by various of the accompanying illustrations with remarks pertinent to some specific feature of their lubrication. These exemplify the necessity for continual care in the handling of lubricants in order that spoilage of materials will be prevented and that protection of the operating mechanisms will be assured so that the productive efficiency of the plant as a whole may not be disturbed.

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TEXACO LUBRICANTS
IN MODERN FOOD HANDLING SERVICE

CONVEYORS, ELEVATORS AND LINE SHAFTING

PLAIN BEARINGS	
Oil Lubricated	TEXACO ALEPH or ALTAIR OIL
Grease Lubricated	TEXACO STAR GREASES or TEXACO STARFAK GREASES
BALL OR ROLLER BEARINGS	
Light to Medium Duty	TEXACO STARFAK GREASE No. 2
For Heavy Duty	TEXACO STARFAK GREASE No. 3
Oil Lubricated	TEXACO REGAL OIL B or TEXACO CETUS OIL

POWER TRANSMISSION MACHINERY

ELECTRIC MOTORS	
Bearings (Oil Lubricated)	TEXACO CANOPUS, NABOB or ALEPH OIL
(Grease Lubricated)	TEXACO STARFAK GREASE No. 2 or No. 3
BUILT-IN GEARS	TEXACO ALTAIR or ARIES OIL or TEXACO MARFAK No. 1
GEARS	
Worm Drives	TEXACO 650T CYLINDER OIL
Bevel Gears (Enclosed)	TEXACO ARIES or ARCTURUS OIL
(Exposed)	TEXACO CRATER No. 1
CHAINS	
Silent Chain Drives	TEXACO TEXOL E or ALTAIR OIL
Exposed Installations	TEXACO CRATER B or No. 00

POWER PLANT

REFRIGERATING MACHINERY	
Cylinders (According to Design)	TEXACO CAPELLA OILS
Bearings (External)	TEXACO NABOB or ALEPH OIL
Crankcase Service	SAME OIL AS IN CYLINDERS
STEAM CYLINDERS	
Low Pressure Service	TEXACO DRACO CYLINDER OIL
Medium Pressure Service	TEXACO PINNACLE CYLINDER OIL
BEARINGS (External)	TEXACO NABOB or ALEPH OIL
(Enclosed)	TEXACO REGAL OIL B or C
BEARINGS (Grease Lubricated)	TEXACO STAR GREASE No. 1 or No. 3

CANNING MACHINERY

BEARINGS	
Sleeve Type—Oil Lubricated	TEXACO ALEPH or ALTAIR OIL
Grease Lubricated	TEXACO STAR GREASES
BALL OR ROLLER TYPE	
(Light to Medium Duty)	TEXACO STARFAK GREASE No. 2
(Heavy Duty)	TEXACO STARFAK GREASE No. 3
CIRCULATING SYSTEMS	TEXACO ALGOL OIL
GEARING	
Exposed to Water or Acids	TEXACO MARINE ENGINE OIL A or TEXACO DOLPHIN MARINE ENGINE OIL
Enclosed (Bath Lubricated)	TEXACO ARIES or ARCTURUS OIL
PITMAN SHAFTS	TEXACO 650T CYLINDER OIL

COOKING, CLOSING AND SEAMING EQUIPMENT

BEARINGS AND SPINDLES	TEXACO STAR GREASES
SEAMER ROLLS	TEXACO MARFAKS
TOP DRIVING HEADS	TEXACO MARFAKS
VACUUM VALVES	TEXACO URSA OIL HEAVY
BEARINGS, AIR VALVES AND ENCLOSED GEARS ON COOKERS	TEXACO MARINE ENGINE OIL A or TEXACO DOLPHIN MARINE ENGINE OIL
DRIVING GEARS (Exposed)	TEXACO CRATER No. 1 or No. 2
VERTICAL BEARINGS IN EXHAUSTERS	TEXACO MARFAK No. 3
SPROCKET SPINDLES OF STEAM BOXES	TEXACO CAVIS MINERAL CYLINDER OIL or TEXACO CRATER No. 00